

1 CLAIMS:

2 1. An apparatus for producing an extruded film tube and supplying said tube to
3 a collapsing and roller assembly, comprising:

4 (a) a die for extruding a molten material in the form of a tube which is in
5 a molten state below a frost line and which is in a solid state above
6 said frost line;

7 (b) a blower system for supplying and exhausting cooling air to and from
8 an interior portion of said tube;

9 (c) a flow control valve for regulating the at least a portion of said blower
10 system to control the extrusion and cooling process, and which
11 determines in part the circumference of said tube;

12 (d) at least one sizing sensor located proximate said tube in a position
13 below said frost line for sensing the position of said tube, comparing
14 such position to an extrusion set point, and generating an extrusion
15 feedback error signal which is corrective of any difference between
16 said position and said set point;

17 (e) at least one lay flat sensor located proximate said tube in a position
18 above said frost line for sensing the position of said tube prior to the
19 collapsing and flattening of said tube by said collapsing and roller
20 assembly, comparing said position to a lay-flat set point, and
21 generating a lay-flat feedback error signal which is corrective of any
22 difference between said position and said lay-flat set point;

23 (f) a programmable controller for executing program instructions including
24 a negative feedback control system which receives said extrusion
25 feedback error signal and said lay-flat feedback error signal as negative
26 feedback injection signals and which provides a control signal to said
27 valve.

1 2. An apparatus according to claim 1, wherein said at least one sizing sensor
2 and said at least one lay flat sensor are maintained in different circumferential
3 positions relative to said tube.
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5 3. An apparatus according to claim 1, wherein said lay-flat feedback error signal
6 is provided in the same units as said extrusion feedback error signal.
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8 4. An apparatus according to claim 1, wherein said extrusion feedback error
9 signal defines a primary control feedback control loop, and wherein said lay-flat
10 feedback error signal defines a supplemental feedback control loop.
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12 5. An apparatus according to claim 1, wherein said lay-flat feedback error
13 signal is injected directly into said extrusion feedback control loop.
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15 6. An apparatus according to claim 1, wherein said lay-flat feedback error signal
16 is analyzed prior to injection to determine if it is within a range of acceptable
17 positions.
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19 7. An apparatus according to claim 1, wherein said lay-flat feedback error signal
20 is analyzed prior to injection to determine if it is within an acceptable range of
21 signal rates of change.
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1 8. An apparatus for producing an extruded film tube and supplying said tube to
2 a collapsing and roller assembly, comprising:

3 (a) a die for extruding a molten material in the form of a tube which is in a
4 molten state below a frost line and in a solid state above said frost line;

5 (b) a blower system for supplying and exhausting cooling air to and from
6 an interior portion of said tube;

7 (c) a valve for regulating the at least a portion of said blower system to
8 control the extrusion and cooling process, and which determines in part
9 the circumference of said tube;

10 (d) at least one acoustic sensor located proximate said tube in a position
11 below said frost line for sensing the position of said tube, comparing such
12 position to an extrusion set point, and generating an extrusion feedback
13 error signal which is corrective of any difference between said position
14 and said set point;

15 (e) at least one non-contact sensor located proximate said tube in a
16 position above said frost line for sensing the position of said tube prior to
17 the collapsing and flattening of said tube by said collapsing and roller
18 assembly, comparing said position to a lay-flat set point, and generating a
19 lay-flat feedback error signal which is corrective of any difference
20 between said position and said lay-flat set point;

21 (f) a programmable controller for executing program instructions including
22 a negative feedback control system which receives said extrusion
23 feedback error signal and said lay-flat feedback error signal as negative
24 feedback injection signals and which provides a control signal to said
25 valve.
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1 9. An apparatus according to claim 8, wherein said at least one acoustic sensor
2 and said at least one non-contact sensor are maintained in different circumferential
3 positions relative to said tube.

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5 10. An apparatus according to claim 8, wherein said lay-flat feedback error signal
6 is provided in the same units as said extrusion feedback error signal.

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8 11. An apparatus according to claim 8, wherein said extrusion feedback error
9 signal defines a primary control feedback control loop, and wherein said lay-flat
10 feedback error signal defines a supplemental feedback control loop.

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12 12. An apparatus according to claim 8, wherein said lay-flat feedback error
13 signal is injected directly into said extrusion feedback control loop.

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15 13. An apparatus according to claim 8, wherein said lay-flat feedback error signal
16 is analyzed prior to injection to determine if it is within a range of acceptable
17 positions.

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19 14. An apparatus according to claim 8, wherein said lay-flat feedback error signal
20 is analyzed prior to injection to determine if it is within an acceptable range of
21 signal rates of change.

1 15. A method of producing an extruded film tube and supplying said tube to a
2 collapsing and roller assembly, comprising:

- 3 (a) extruding a molten material from a die in the form of a tube which is in
4 a molten state below a frost line and in a solid state above said frost line;
- 5 (b) utilizing a blower system for supplying and exhausting cooling air to
6 and from an interior portion of said tube;
- 7 (c) utilizing a flow control valve for regulating the at least a portion of said
8 blower system to control the extrusion and cooling process, and which
9 determines in part the circumference of said tube;
- 10 (d) locating at least one acoustic sensor proximate said tube in a position
11 below said frost line for sensing the position of said tube;
- 12 (e) comparing such position to an extrusion set point;
- 13 (f) generating an extrusion feedback error signal which is corrective of
14 any difference between said position and said set point;
- 15 (g) locating at least one non-contact sensor located proximate said tube in
16 a position above said frost line for sensing the position of said tube prior
17 to the collapsing and flattening of said tube by said collapsing and roller
18 assembly;
- 19 (h) comparing said position to a lay-flat set point;
- 20 (i) generating a lay-flat feedback error signal which is corrective of any
21 difference between said position and said lay-flat set point;
- 22 (j) providing programmable controller for executing program instructions;
- 23 (k) including in said programmable instructions a negative feedback
24 control system which receives said extrusion feedback error signal and
25 said lay-flat feedback error signal as negative feedback injection signals
26 and which provides a control signal to said valve.

1 16. A method according to claim 15, further comprising:

2 locating said at least one acoustic sensor and said at least one non-contact sensor
3 in different circumferential positions relative to said tube.

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5 17. A method according to claim 15, wherein said lay-flat feedback error signal
6 is provided in the same units as said extrusion feedback error signal.

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8 18. A method according to claim 15, wherein said extrusion feedback error
9 signal defines a primary control feedback control loop, and wherein said lay-flat
10 feedback error signal defines a supplemental feedback control loop.

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12 19. A method according to claim 15, wherein said lay-flat feedback error signal
13 is injected directly into said extrusion feedback control loop.

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15 20. A method according to claim 15, wherein said lay-flat feedback error signal
16 is analyzed prior to injection to determine if it is within a range of acceptable
17 positions.

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19 21. A method according to claim 15, wherein said lay-flat feedback error signal
20 is analyzed prior to injection to determine if it is within an acceptable range of
21 signal rates of change.